

WHAT IS CLAIMED IS:

1. A fluid fitting assembly for a fluid-tight coupling of a tube member, having a conduit, to a connector member having a receiving port defined by an interior sealing wall and formed for sliding receipt of the distal end of said tube member therein, said connector member further defining a passage extending therethrough and terminating in the receiving port, said fitting assembly comprising:

a RAM device a having proximal surface and an opposite distal surface facing toward said connector member, and having an interior alignment wall defining a alignment passage extending from the proximal face to the distal face for sliding receipt of the tube member therethrough; and

a ferrule device having a proximal tube engaging portion, an opposite distal sealing portion and a tube receiving passage extending from the tube engaging portion to the sealing portion and formed for receipt of the tube member therethrough, said tube engaging portion being formed and dimensioned to contact the RAM device alignment wall and said sealing portion being formed and dimensioned to contact the connector member sealing wall such that when a compression force is increasingly applied to the RAM device in the direction toward the connector member, the RAM device alignment wall contacts the ferrule device tube engaging portion in manner increasingly radially gripping the tube member for movement of the ferrule device and the RAM device, as a unit, toward the connector member to increasingly urge the ferrule device sealing portion into fluid sealing engagement with the connector member sealing wall and to fluidly couple the tube member conduit to the connector member passage.

2. The fluid fitting assembly as defined by claim 1, further including:

a spanner nut defining an access port for receipt of said tube member therethrough, adapted to engage said RAM device to exert said compression force.

3. The fluid fitting assembly as defined by claim 2, wherein
the sealing portion of the ferrule device includes a sealing surface
tapering inwardly toward the distal end thereof, and formed increase the contact
area with the connector member sealing wall as the compression force is
5 increasingly applied.

4. The fluid fitting assembly as defined by claim 3, wherein
said tube receiving passage of the ferrule device is defined by a
substantially cylindrical interior wall, and said ferrule device further including:
10 a retention collar extending inwardly from said interior wall, and
positioned proximate to the distal end of said sealing portion.

5. The fluid fitting assembly as defined by claim 2, wherein
said tube engaging portion of the ferrule device includes an interior
15 gripping surface defining at least a portion of the tube receiving passage
proximate the tube engaging portion, said interior gripping surface increasingly
circumferentially gripping said tube member as the compression force is
increasingly applied.

20 6. The fluid fitting assembly as defined by claim 5, wherein
the interior alignment wall of the RAM device includes a contacting wall
tapering inwardly in a direction toward the proximal surface, and
said tube engaging portion of the ferrule device includes a proximal
contacting rim adapted to contact the inwardly tapered contacting wall of the
25 RAM device in a manner causing the interior gripping surface of the ferrule
device tube receiving passage to increasingly radially engage the tube member.

7. The fluid fitting assembly as defined by claim 6, wherein
said interior alignment wall of the RAM device further includes a
30 substantially cylindrical support wall extending in a direction distally from the
contacting wall and terminating at the distal surface thereof to define a ferrule

receiving recess, and

said tube engaging portion of the ferrule device further includes a substantially cylindrical alignment surface extending distally from the contacting rim, and formed and dimensioned for sliding engagement with the substantially cylindrical support wall of the RAM device.

8. The fluid fitting assembly as defined by claim 6, wherein the proximal end of the ferrule device tube engaging portion tapers inwardly to define the contacting rim.

9. The fluid fitting assembly as defined by claim 8, wherein said engaging portion includes at least one longitudinally extending slot to facilitate engagement with said tube member.

10. The fluid fitting assembly as defined by claim 8, wherein said ferrule device includes a distal shoulder portion adapted to contact a proximal face of the connector member to limit insertion of the ferrule device sealing portion into the connector member receiving port, and a proximal shoulder portion adapted to contact the distal surface of the RAM device to limit insertion of the tube engaging portion of the ferrule device into the RAM device alignment passage.

11. A fluid fitting assembly for a fluid-tight coupling of a plurality of tube members, each having a conduit, to a connector member as a unit, said connector member having a plurality of receiving ports each defined by an interior sealing wall and formed for sliding receipt of a distal end of a corresponding tube member therein, said connector member further defining a plurality of passages each extending therethrough and terminating in a corresponding receiving port, said fitting assembly comprising:

a RAM device having a proximal surface and an opposite distal surface facing toward said connector member, and having a plurality of alignment

passages each defined by an alignment passage extending from the proximal face to the distal face for sliding receipt of a respective tube member therethrough; and

5 a plurality of ferrule devices each having a proximal tube engaging portion, an opposite distal sealing portion and a tube receiving passage extending from the tube engaging portion to the sealing portion and formed for receipt of a respective tube member therethrough, each said tube engaging portion being formed and dimensioned to contact a respective alignment wall of the RAM device and each said sealing portion of the ferrule device being
10 formed and dimensioned to contact a respective sealing wall of the connector member such that when a compression force is increasingly applied to the RAM device in the direction toward the connector member, the respective alignment walls of the RAM device contact the tube engaging portions of the ferrule devices in a manner increasingly radially gripping the corresponding
15 tube members for movement of the ferrule devices and the RAM device, as a unit, toward the connector member to increasingly urge the ferrule device sealing portions into fluid sealing engagement with the connector member sealing wall and to fluidly couple the tube member conduits to the corresponding connector member passages.

20

12. The fluid fitting assembly as defined by claim 1, further including:

a spanner nut defining an access port for receipt of said tube members therethrough, and adapted to engage said RAM device to exert said compression force.

25

13. The fluid fitting assembly as defined by claim 11, wherein

the sealing portions of each ferrule device include a sealing surface tapering inwardly toward the distal end thereof, and formed increase the contact area with the respective sealing wall of the connector member as the
30 compression force is increasingly applied

14. The fluid fitting assembly as defined by claim 13, wherein each sealing portion of the ferrule device is conical-shaped.

15. The fluid fitting assembly as defined by claim 14, wherein
5 each ferrule device includes a distal shoulder portion adapted to contact a proximal face of the connector member to limit insertion of the ferrule device sealing portion into the connector member receiving port.

16. The fluid fitting assembly as defined by claim 15, wherein
10 each distal shoulder portion extends circumferentially around the respective ferrule device.

17. The fluid fitting assembly as defined by claim 11, wherein
each tube engaging portion of the respective ferrule device includes an
15 interior gripping surface defining at least a portion of the tube receiving passage proximate the tube engaging portion, said interior gripping surface increasingly circumferentially gripping the respective tube member as the compression force is increasingly applied.

18. The fluid fitting assembly as defined by claim 17, wherein
each interior alignment wall of the RAM device includes a contacting
wall tapering inwardly in a direction toward the proximal surface, and
each tube engaging portion of the respective ferrule device includes a
proximal contacting rim adapted to contact the inwardly tapered contacting wall
25 of the RAM device in a manner causing the interior gripping surface of the respective tube receiving passage of the ferrule device to increasingly radially engage the tube member.

19. The fluid fitting assembly as defined by claim 18, wherein
30 each interior alignment wall of the RAM device further includes a substantially cylindrical support wall extending in a direction distally from the

contacting wall and terminating at the distal surface thereof to define a ferrule receiving recess, and

each tube engaging portion of the ferrule device further includes a substantially cylindrical alignment surface extending distally from the contacting rim, and formed and dimensioned for sliding engagement with the
5 respective substantially cylindrical support wall of the RAM device.

20. The fluid fitting assembly as defined by claim 19, wherein
 the proximal end of the each ferrule device tube engaging portion tapers
10 inwardly to define the contacting rim.

21. The fluid fitting assembly as defined by claim 20, wherein
 the inwardly taper of the each contacting rim is curvilinear in profile

15 22. The fluid fitting assembly as defined by claim 19, wherein
 each said ferrule device includes a proximal shoulder portion adapted to
 contact the distal surface of the RAM device to limit insertion of the tube
 engaging portion of the ferrule device into the respective RAM device
 receiving recess.

20 23. The fluid fitting assembly as defined by claim 13, wherein
 each tube receiving passage of the respective ferrule device is defined by
 a substantially cylindrical interior wall, and each ferrule device further
 including:

25 a retention collar extending inwardly from said interior wall, and
 positioned proximate to the distal end of the respective sealing portion.

24. The fluid fitting assembly as defined by claim 17, wherein
 each said engaging portion of the ferrule device includes at least one
30 longitudinally extending slot to facilitate engagement with the respective tube
 member.

25. The fluid fitting assembly as defined by claim 12, wherein
an annular under-shoulder of the spanner nut slideably contacts an
annular contact shoulder of RAM device to exert said compression force.

5

26. The fluid fitting assembly as defined by claim 25, wherein
a central ferrule receiving recess positioned proximate a center of said
RAM device is off-set a predetermined distance closer to the connector member
relative the surrounding receiving recesses.

10

27. The fluid fitting assembly as defined by claim 26, wherein
said predetermined distance is in the range of about 0.004 inch to about
0.006 inch.

15

28. A fluid connection system comprising:

a plurality to tube member each having a fluid conduit extending
therethrough and terminating at respective distal ends thereof,

a fluid distribution device having a housing formed to seat a connection
member having a plurality of receiving ports each defined by an interior sealing
wall and formed for sliding receipt of a distal end of a corresponding tube
member therein, said connector member further defining a plurality of passages
each extending therethrough and terminating in a corresponding receiving port;

20

a RAM device having proximal surface and an opposite distal surface
facing toward said connector member, and having a plurality of alignment
passages each defined by an alignment passage extending from the proximal
face to the distal face for sliding receipt of a respective tube member
therethrough; and

25

a plurality of ferrule devices each having a proximal tube engaging
portion, an opposite distal sealing portion and a tube receiving passage
extending from the tube engaging portion to the sealing portion and formed for
receipt of a respective tube member therethrough, each said tube engaging

30

portion being formed and dimensioned to contact a respective alignment wall of the RAM device and each said sealing portion of the ferrule device being formed and dimensioned to contact a respective sealing wall of the connector member; and

5 a spanner nut defining an access port for receipt of said tube members therethrough, and adapted cooperate with the housing of the fluid distribution device to increasingly exert a compression force on said RAM device such that the respective alignment walls of the RAM device contact the tube engaging portions of the ferrule devices in a manner increasingly radially gripping the
10 corresponding tube members for movement of the ferrule devices and the RAM device, as a unit, toward the connector member to increasingly urge the ferrule device sealing portions into fluid sealing engagement with the connector member sealing wall and to fluidly couple the tube member conduits to the corresponding connector member passages.

15 29. The fluid fitting assembly as defined by claim 28, wherein the sealing portions of each ferrule device include a sealing surface tapering inwardly toward the distal end thereof, and formed increase the contact area with the respective sealing wall of the connector member as the
20 compression force is increasingly applied

30. The fluid fitting assembly as defined by claim 28, wherein each tube engaging portion of the respective ferrule device includes an interior gripping surface defining at least a portion of the tube receiving passage
25 proximate the tube engaging portion, said interior gripping surface increasingly circumferentially gripping the respective tube member as the compression force is increasingly applied.

31. The fluid fitting assembly as defined by claim 30, wherein
30 each interior alignment wall of the RAM device includes a contacting wall tapering inwardly in a direction toward the proximal surface, and

each tube engaging portion of the respective ferrule device includes a proximal contacting rim adapted to contact the inwardly tapered contacting wall of the RAM device in a manner causing the interior gripping surface of the respective tube receiving passage of the ferrule device to increasingly radially engage the tube member.

32. The fluid fitting assembly as defined by claim 31, wherein each interior alignment wall of the RAM device further includes a substantially cylindrical support wall extending in a direction distally from the contacting wall and terminating at the distal surface thereof to define a ferrule receiving recess, and

each tube engaging portion of the ferrule device further includes a substantially cylindrical alignment surface extending distally from the contacting rim, and formed and dimensioned for sliding engagement with the respective substantially cylindrical support wall of the RAM device.

33. The fluid fitting assembly as defined by claim 30, wherein each tube receiving passage of the respective ferrule device is defined by a substantially cylindrical interior wall, and each ferrule device further including:

a retention collar extending inwardly from said interior wall, and positioned proximate to the distal end of the respective sealing portion.

34. The fluid fitting assembly as defined by claim 33, wherein each said engaging portion of the ferrule device includes at least one longitudinally extending slot to facilitate engagement with the respective tube member.

35. The fluid fitting assembly as defined by claim 28, wherein an annular under-shoulder of the spanner nut slideably contacts an annular contact shoulder of RAM device to exert said compression force.

36. The fluid fitting assembly as defined by claim 35, wherein
a central ferrule receiving recess positioned proximate a center of said
RAM device is off-set a predetermined distance closer to the connector member
5 relative the surrounding receiving recesses.

5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100